ISSN: 0974-5335
IJLST (2015), 8(2):10-12

Comparative Analysis of Effect of Lead and Chromium on *Datura inoxia* in Tissue Culture

Ashwini A. Waoo[1], Swati Khare[2], Sujata Ganguly[3]

1, 3 Department of Botany, Barktullah University, Govt. M.V.M., Bhopal, INDIA
2 Department of Biotechnology, Institute for Excellence in Higher Education (IEHE), Bhopal, INDIA
ashwini_waoo@rediffmail.com, swatiikhare@yahoo.com

ABSTRACT:
Recently industrialization has become an ecosystem threat and ultimately hazardous to health of living organisms. But fact is that industries are required for the economy modernization and development of the city like Bhopal. Therefore environmental pollution with toxic chemicals and metals is a global problem. Keeping this in to an account this research was carried out to analyze the effect of Lead and Chromium on the in vitro plantlets of *Datura inoxia*. The potential of *Datura inoxia* as an important plant for phytoremediation of soil by heavy metals has been identified but its potential for phytoremediation of contaminated sites is unknown yet. The main objective of the present study was to determine the effect of Lead and Chromium on growth and metal uptake in different parts of *Datura inoxia* shoots grown in vitro in medium containing these heavy metals.
Keywords: Bhopal, Lead, Chromium, *Datura inoxia*, Soil, Phytoremediation, Pollution.

INTRODUCTION

Existence of heavy metals in high concentration into the environment results in severe ecological and health problems [1]. By polluting food chain, these elements became a risk to environmental and human health. Their presence in the ecosystems causes accumulation by living organisms in their bodies.

For normal growth and reproduction of plants, they must absorbs macronutrients such as N, P, K, S, Ca, Mg and essential micronutrients like Zn, Fe, Ni, Mn, Mo and Cu. In the course of evolution various mechanisms have evolved in plants for uptake, translocation, and storage of these nutrients. These mechanisms are very specific, and their specificity based on the structural and functional aspect of transporter proteins in the cell membrane [2]. But sometimes along with these due to contaminated soil plants may absorb and store heavy metals. On the basis of individual characteristics of metal, they are available in soil in various fractions such as in the form of free metal ions and soluble metal complexes in soil, in the form of adsorbed compounds or may be attached to soil organic matter [3].

Heavy metal contaminated sites at industrially contaminated area that require remediation often contain a complex mixture of heavy metals and organic contaminants. Thus very little is carried out. Yet, little is known about phytoremediation systems capable of remediating mixtures of contaminants [4], Lead is one of the most persistent heavy metal; showing half-life of more than 1000 years [5]. The major sources of lead contamination are mining and smelting, pesticides, sewage, and vehicle exhausts [6].

These toxic heavy metals which are released into the environment, contribute to a various toxic effects on human being and all ecosystem [7], by the phenomenon of bio-magnification and accumulation.

Heavy metals are proven to be major environmental pollutants, particularly in industrial areas. Conventionally the soil has been used for dumping of the heavy metal wastes before processing. After that the traditional remediation methods for heavy metal pollution in soil are very expensive and not very eco friendly [8].

Many industries like leather, chemical, electro painting, and textile manufacturing are responsible for chromium pollution in soil as well as water. Uptake of chromium by roots and its transportation to aerial tissue is low at or near-neutral pH. Foliar concentrations show little relationship with overall soil chromium concentrations [9].

There are some preventive or controlling measures for it but most of the conventional remedial technologies are expensive and inhibit the soil fertility; this subsequently causes negative impacts on the ecosystem overall balance. The solution to this problem comes from the concept of phytoremediation. Phytoremediation is a cheap, environmental friendly, aesthetic and green approach most suitable for developing countries and city like Bhopal.

EFFECT OF LEAD AND CHROMIUM ON SURVIVAL OF *DATURA INOXIA*

Multiplication trials were conducted on established culture of *Datura inoxia*. For each species the multiplication trial involved placing shoot tips, and nodal segments in test tubes with multiplication media.

To evaluate the abilities of different concentrations of media to support shoot culture establishment and multiplication, full and half strength of either M. S. Salts and their combination (full M. S. salt and B5 vitamins) were supplemented with 0.5 mg/l BAP in combination with 0.5 mg/l NAA. These tubes were cultured under standard production conditions as per culture initiation for 4 weeks, after which a shoot from each treatment was transferred to fresh treatment medium and cultured another 4 weeks (total of 8 weeks). Data was collected on the parameters of color, health of shoots, number and length of new shoots at 2 and 4 weeks and an optimum multiplication media was chosen for each species.

Inoculated cultures were incubated in the culture or growth room at controlled environment of the temperature of 25 +/- 4 ^{0}C of 16 hours photoperiod of 2000 lux and dark condition. Once in the lab, nodal and shoot tip explants placed on initiation medium, and cultured for up to 8 weeks under fluorescent lights at room temperature. All the observations were taken after 10 to 15 days in case of color, new growth, death, and contamination (i.e. bacterial and/or fungal growth). Explants were considered dead if they were lost their green colour, or no new growth, and the interior tissue was brown.

OBSERVATIONS AND RESULTS

Established shoot cultures of *Datura inoxia* were used for this experiment. In spite of standard M. S. Media, Shoot cultures were exposed to different concentration of Lead and Chromium (0-50 mg/l). Percentage of survival and shoot length was measured after 7-10 days of exposure. Differential response in Percentage of survival and shoot length was noted. *Datura inoxia* was more tolerant towards Chromium as compared to Lead. Analysis of data has shown that *Datura inoxia* has percentage of survival on up to 50 mg/l for Lead and 45 mg/l for Chromium.

The effect of all treatments of heavy metals was tabulated below in Table 1 with Figure 1. For the assessment of effect of these heavy metals here percentage of survival of culture in various treatments of heavy metals was taken in to consideration.

CONCLUSION

The popularity of phytoremediation is based in part on the relatively low cost of phytoremediation, for environmental cleanup as the costs associated with environmental remediation are staggering. Tissue cultures offer more than just experimental convenience and speed compared with whole plant systems. By eliminating the effects of micro flora and revealed intrinsic capacity of plant cells for detoxification of pollutants can be obtained. *Datura inoxia* has shown the effective results in case of Lead and Chromium. This plant must be used for phyotoremediation of industrially contaminated sites. The results are promising; and also suggest that further development is needed.

Table 1 Comparative Effect of Heavy Metals on *Datura inoxia*

Treatments Number (0.5 mg/l-50 mg/l)	**Percentage of Survival on Lead**	**Percentage of Survival on Chromium**
T1	98	97
T2	90	92
T3	82	91
T4	75	78
T5	75	74
T6	70	69
T7	70	68
T8	60	65
T9	55	50
T10	54	52
T11	50	48
T12	50	45
T13	45	40
T14	40	32
T15	40	0

Table 1 shows the number of treatments given, in case of chromium and Nickel. The values represented in table shows the average value of percentage of survival of *Datura inoxia*.

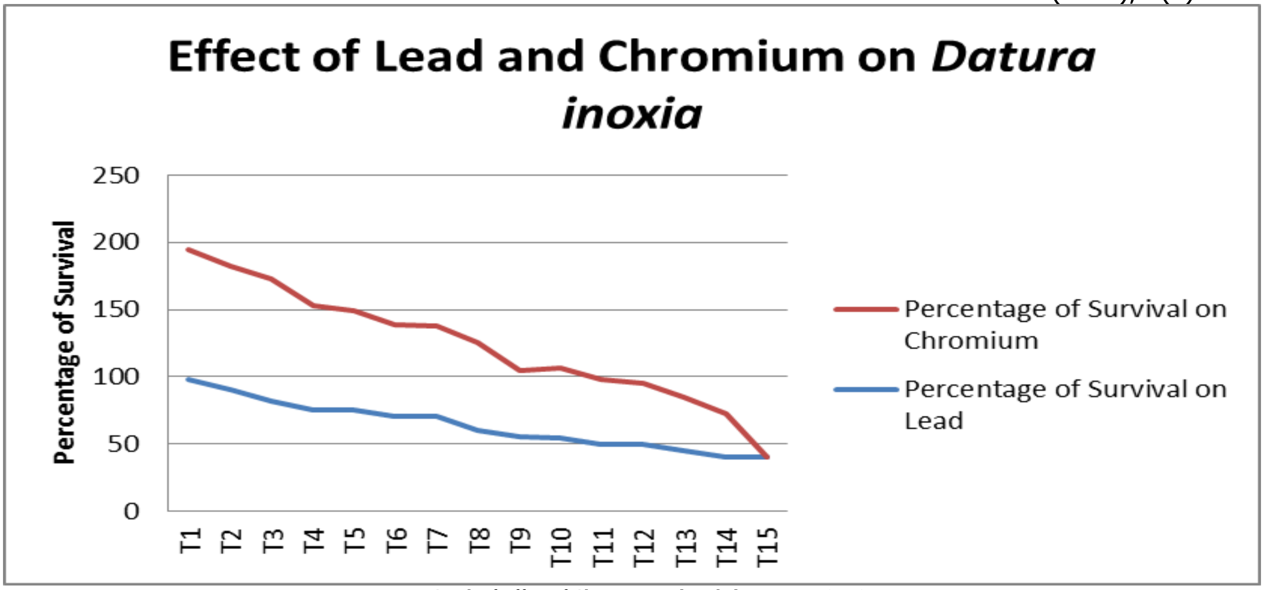

Fig.1 Graph of Effect of Chromium and Nickel on *Datura inoxia*.
Figure 1 shows the graph of the effect of Chromium and Nickel on percentage of survival of *Datura inoxia*.

REFERENCES

[1] Cerbasi, I. H., Yetis, U., (2001) Biosorption of Ni(ii) and Pb(ii) by Phanerochaete chrysosporium from binary metal system – Kinetics, Water Res., 27, 15–20.

[2] Pollard, J.A. and Baker, A.J.M., (1997) Deterrence of Herbivory by Zinc Hyperaccumulation in Thlaspi caerulescens (Brassicacea), New Phytol., 135: 655-658.

[3] Mathew, A. M., (2005) Phytoremediation of Heavy Metal Contaminated Soil, Oklahoma Thesis, State University.

[4] Waoo, A., Khare, S., Ganguli, S., (2014) Comparative Tissue Culture Studies on Lanatana camara and *Datura inoxia* at Heavy Metal contaminated site and Phytoremediation approach at Industrial Region of Bhopal, International Journal of Advances in Biology (IJAB), 1(1).

[5] Merrington, G., (1995) Historic metalliferous mine sites: a major source of heavy metal contamination? Land Contamination and Reclamation 3, 3, 173-179.

[6] Davies, B. E., (1995) Lead. In "Heavy Metals In Soils" (Ed. Alloway B.J.), 206-223.

[7] Dembitsky, V., (2003), Natural occurrence of arseno compounds in plants, lichens, fungi, algal species, and microorganisms, Plant Sci., 165: 1177-1192.

[8] Aboulroos, S. A., Helal, M.I.D. and Kamel, M. M., (2006), Remediation of Pb and Cd polluted soils using in situ immobilization and phytoextraction techniques, Soil Sediment Contam., 15: 199-215.

[9] McGrath, S.P., (1995) Chromium and Nickel. In Heavy Metals in Soils (Ed. Alloway B.J.). 152-178.